

REMARKS

Claims 1-18 are pending in the present application. Claims 1-5 and 12-16 are withdrawn from consideration. Claims 17 and 18 are newly added. No new matter has been entered.

Support for new claims 17 and 18 can be found in, *e.g.*, original claims 7 and 8.

As is described in the present specification, Nd-Fe-B based permanent magnets have the drawback that they are susceptible to oxidation in humid air within a brief time because they contain rare earth elements and iron as predominant components. When they are incorporated in magnetic circuits, some problems arise that the output of magnetic circuits is reduced by such oxidation and the periphery is contaminated with rust.

In particular, Nd-Fe-B based permanent magnets have recently found use in motors such as automobile motors and elevator motors, where the magnets must work in a hot humid environment. It must be expected that the magnets are also exposed to salt moisture during the service. It is thus required to endow the magnets with corrosion resistance at low cost. Additionally, in the manufacturing process of such motors, the magnets can be heated at or above 300°C, though briefly. In such a situation, the magnets must be heat resistant too.

The present invention is made to provide R-T-M-B based rare earth permanent magnets such as Nd magnets which withstand use under the above-mentioned harsh conditions; and its object is to provide corrosion resistant rare earth magnets in which the magnets are provided with corrosion resistant, heat resistant coatings, and methods for preparing the same.

According to the invention, corrosion resistant rare earth magnets having heat resistance can be produced at low costs by applying a treating liquid comprising at least one flaky fine

Amendment under 37 CFR §1.111
Attorney Docket No.: 062894
Application No.: 10/589,360

powder selected from the group consisting of Al, Mg, Ca, Zn, Si, Mn, and alloys thereof and a silane and/or a partial hydrolyzate thereof to a surface of the rare earth permanent magnet to form a coating of flaky fine powder/silane and/or partially hydrolyzed silane and heating it to provide a composite film to the magnet surface.

Thus, the present invention relates to corrosion resistant rare earth magnets in which a flaky fine metal powder (Al, Mg, Ca, Zn, Si, Mn or an alloy thereof) is used in combination with a silane and/or a partial hydrolyzate thereof.

Claim Rejections – 35 U.S.C. § 103

A. Hamada in view of Nishiuchi

Claims 6-11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over **Hamada** (US 2003/0079805) in view of **Nishiuchi** (US 6,376,089).

Favorable reconsideration is requested.

Applicants respectfully submit that it would not have been obvious to one of ordinary skill in the art to combine Hamada and Nishiuchi.

Hamada discloses a corrosion resistant rare earth magnet comprising a rare earth permanent magnet and a composite coating formed on a surface of the permanent magnet by treating the permanent magnet with a solution comprising at least one flake fine powder selected from the group consisting of Al, Mg, Ca, Zn, Si, Mn and alloys thereof and a silicone resin, followed by heating. Thus, Hamada discloses the use of a flake fine metal powder in combination with a silicone resin such as Straight Silicone Varnish and Polyester Silicone Varnish.

Amendment under 37 CFR §1.111
Attorney Docket No.: 062894
Application No.: 10/589,360

The Office Action acknowledges that Hamada does not disclose the use of a silane and/or a partial hydrolyzate thereof in the composite coating of Hamada. (Office Action, pages 2-3.) The Office Action cites Nishiuchi for disclosing this feature.

Nishiuchi discloses a process for producing a rare earth metal-based permanent magnet having a corrosion-resistant film, comprising the steps of applying, to the surface of a magnet, a treating solution containing a silicon compound having at least one hydroxyl group and/or at least one hydrolyzable group and inorganic fine particles having an average particle size in a range of 1 nm to 100 nm, and subjecting the magnet having the treating solution applied thereto to a heat treatment.

In this case, the silicon compound is a compound represented by a general formula, $R^1_nSiX_{4-n}$ wherein R^1 is a lower alkyl group which may have a substituent group, a lower alkenyl group, or an aryl group which may have a substituent group; X is hydroxyl group or OR^2 (wherein R^2 is a lower alkyl group which may have a substituent group, an acyl group, an aryl group which may have a substituent group, or an alkoxyalkyl group); and n is an integer of 0 to 3. Thus, Nishiuchi discloses the use of silane.

However, since silicone resin as in Hamada such as straight silicone varnish and polyester silicone varnish is quite different from a silane or a partial hydrolyzate thereof, one of ordinary skill in the art would not expect from Hamada in view Nishiuchi that the combined use of a flake fine metal powder with a silane and/or partial hydrolyzate thereof would impart improved corrosion resistance.

Amendment under 37 CFR §1.111
Attorney Docket No.: 062894
Application No.: 10/589,360

In the attached Declaration, experimental results demonstrate the use of flake metal powder without silane and/or a partial hydrolyzate thereof as in Hamada and the use of silane without flake metal powder as in Nishiuchi when conducting salt spray tests. As demonstrated by the results, the combined use of a silane and/or a partial hydrolyzate thereof with a flake metal powder imparts unexpectedly improved results over Hamada and Nishiuchi. The combined use of a silane and/or a partial hydrolyzate thereof with a flake metal powder imparts excellent corrosion resistance, *i.e.*, 500 to 1,000 hours pass until brown rust generates when conducting salt spray tests.

Since it would not have been obvious to one of ordinary skill in the art to combine Hamada and Nishiuchi, the claims are non-obvious over the cited references.

B. Hoshi in view of Hamada

Claims 6-11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over **Hoshi** (US 2003/0041920) in view of **Hamada**.

Favorable reconsideration is requested.

Applicants respectfully submit that it would not have been obvious to one of ordinary skill in the art to combine Hoshi and Hamada.

Hoshi discloses a coated R-T-B magnet comprising an R-T-B magnet and a chemical conversion layer formed thereon. The chemical conversion layer contains an oxide of Mo and a resin, and a coating is further formed on the chemical conversion layer via coupling agent coating. In this case, the coupling agent is titanate coupling agent, silane coupling agent or acetoalkoxy aluminum diisopropylate.

Amendment under 37 CFR §1.111
Attorney Docket No.: 062894
Application No.: 10/589,360

The Office Action acknowledges that Hoshi does not disclose a composite film comprising the flake fine powder and a silane compound as recited in the present claims. (Office Action, page 3.) The Office Action cites Hamada for supporting that it would have been obvious to use a flake fine powder with the coating disclosed in Hoshi.

However, as stated above since silicone resin as in Hamada such as straight silicone varnish and polyester silicone varnish is quite different from a silane or a partial hydrolyzate thereof, one of ordinary skill in the art would not expect from Hoshi in view Hamada that the combined use of a flake fine metal powder with a silane and/or partial hydrolyzate thereof would impart improved corrosion resistance.

The attached Declaration demonstrates the unexpectedly improved results of combining a silane and/or a partial hydrolyzate thereof with a flake metal powder compared with the use of flake metal powder without silane and/or a partial hydrolyzate thereof as in Hamada and with the use of silane without flake metal powder as in Hoshi when conducting salt spray tests.

Since it would not have been obvious to combine Hoshi and Hamada, the claims are non-obvious over the cited references.

For at least the foregoing reasons, claims 6-11, 17 and 18 are patentable over the cited references. Accordingly, withdrawal of the rejection of claims 6-11 is hereby solicited.

In view of the above remarks, Applicants submit that the claims are in condition for allowance. Applicants request such action at an early date.

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Attorney Docket No.: 062894
Application No.: 10/589,360

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,
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Attachment: Declaration